REMARKS

Upon entry of the present amendment, claims 36 and 37 will have been added, and claims 20-37 will be pending. In view of the herein contained amendments and remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections and allowance of the pending application.

The present invention relates to a reception apparatus capable of estimating symbol timing with a time resolution which is twice as high as a sampling period, without increasing the frequency of operation of an A/D conversion circuit. One feature of the present invention is to estimate a first synchronization timing and a second synchronization timing of a received signal at sampling timings corresponding to multiple phases that vary by 180° over a longer time interval than a symbol length. From the first synchronization timing and the second synchronization timing, an estimated third synchronization timing is determined. In other words, a synchronization estimation of a received signal is utilized at two sampling timings corresponding to phases that vary from each other by 180° over a longer time interval than a symbol length. Based on the results of these estimations, a definitive synchronization timing can be established.

Page 13, line 21 to page 14, line 11 of the specification describes the time interval for shifting the phase of the sampling timings. As described therein, once the phase of the sampling timings is shifted, the phase of the sampling timings will not be shifted again within

a one symbol time period. Consequently, sampling is performed at sampling timings of a common type (i.e., common phase) at least for the time period of one symbol, and the phase of the sampling timings is thus shifted at relatively long time intervals.

The present invention is directed to enabling synchronization estimation of a received signal at a high level of accuracy, yet the sampling rate per symbol does not need to be particularly high. The present invention estimates the border of the symbols accurately, so that the phase of the sampling timings can be shifted at time intervals longer than one symbol.

In the Office Action of August 11, 2004, the Examiner rejected claims 20-27 and 33 under 35 U.S.C. § 102(b) as being anticipated by Evenstad (U.S. Patent No. 5,453,834). This rejection is respectfully traversed for the following reasons.

Claim 20 recites that the reception apparatus comprises a first estimator that estimates a first synchronization timing of a received signal at a sampling timing, a switch that shifts a phase of the sampling timing by 180°, a second estimator that estimates a second synchronization timing of the received signal at a sampling timing phase shifted from the sampling timing of the first synchronization timing by 180°, and a third estimator that estimates a third synchronization timing from the first synchronization timing and the second synchronization timing. Claim 20 also recites that the switch shifts the phase of the sampling

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timing at a time interval longer than a symbol duration. Applicants respectfully submit that this combination of features is not disclosed by Evenstad.

Evenstad is directed towards a device for detecting and measuring analog coherent frequency bursts. The device includes a first A/D converter 101 which samples a received signal at a sampling timing, and a second A/D converter 103 which samples the received signal at a sampling timing phase shifted by 180°. See col. 10, lines 40-51. However, Evenstad's device does not include a first estimator that estimates a first synchronization of the received signal at the sampling timing, or a second estimator that estimates a second synchronization timing of the received signal at the phase shifted sampling timing, as recited in claim 20. To illustrate this difference between Evenstad's device and the present invention, Applicants direct the Examiner's attention to Fig. 8 of Evenstad, which shows that each of the A/D converters have a single output to a FIFO buffer. In contrast, Fig. 2 of the present invention illustrates that each of the A/D converters has an output to a digital demodulation circuit 106, and an output to a timing estimating circuit 105. Evenstad also fails to disclose a third estimator for estimating a third synchronization timing from first and second synchronization timings.

Furthermore, Evenstad's device simultaneously provides a sampling timing, and a 180° phase-shifted sampling timing. See Fig. 8. In contrast, the present invention utilizes a switch which shifts a phase of the sampling timing by switching between a sampling timing

and a 180° phase-shifted sampling timing. Furthermore, Evenstad does not disclose shifting the sampling timings at longer time intervals than one symbol. For the above stated reasons, Applicants respectfully submit that the rejection of claim 20 is improper, and request withdrawal of the rejection. Dependent claims 22-27 are also submitted to be in condition for allowance at least in view of their dependence on claim 20.

Claim 33 recites a reception method and includes limitations related to those recited in claim 20. Claim 33 recites estimating a first synchronization timing of a received signal at a sampling timing, shifting a phase of the sampling timing by 180° at a time interval longer than a symbol duration, estimating a second synchronization timing of the received signal at a sampling timing phase shifted from the sampling timing of the first synchronization timing by 180°, and estimating a third synchronization timing from the first and second synchronization timing. As discussed in relation to claim 20 above, this combination of features is not disclosed by Evenstad. Therefore, Applicants respectfully submit that the rejection of claim 33 is also improper, and request withdrawal of the rejection.

Claim 21 also recites that the reception apparatus comprises a first estimator that estimates a first synchronization timing of a received signal at a sampling timing, a second estimator that estimates a second synchronization timing of the received signal at a sampling timing phase shifted from the sampling timing of the first synchronization timing, and a third estimator that estimates a third synchronization timing from the first synchronization timing

and the second synchronization timing. As mentioned above, Evenstad fails to disclose these limitations.

Claim 21 further recites that the reception apparatus comprises a switch that shifts a phase of the sampling timing by inverting a polarity of a reference clock signal, and that the switch inverts the polarity of the reference clock signal at a time interval longer than a symbol duration. As mentioned above, Evenstad's device simultaneously provides a sampling timing, and a 180° phase-shifted sampling timing, and does not provide a switch which switches between a sampling timing and a phase-shifted sampling timing. For this and the above stated reasons, Applicants respectfully submit that the rejection of claim 21 is also improper, and request withdrawal of the rejection.

In the Office Action, the Examiner rejected claims 28-32, 34 and 35 under 35 U.S.C. § 102(a) as being anticipated by Fujitsu (Japanese Patent No. 11004273A). These rejections are respectfully traversed for the following reasons.

The Fujitsu reference is in Japanese and includes an English abstract, which the Examiner has relied upon in his rejections. In his rejections, the Examiner has merely repeated what is recited in the abstract without providing an explanation as to how the features disclosed therein read upon the limitations recited in the claims of the present invention. Since it is not clear, absent some explanation, how the features recited in the

Fujitsu reference anticipate the claimed limitations, Applicants respectfully submit that this rejection is improper.

Section 706.02(II) of the MPEP states, in regards to foreign language documents, that "[c]itation of and reliance upon an abstract without citation of and reliance upon the underlying scientific document is generally inappropriate where both the abstract and the underlying document are prior art... If the document is in a language other than English and the examiner seeks to rely on that document, a translation must be obtained so that the record is clear as to the precise facts the examiner is relying upon in support of the rejection." It furthers states that only "[i]n limited circumstances, it may be appropriate for the examiner to make a rejection in a non-final Office action based in whole or in part on the abstract only without relying on the full text document." Since it is not immediately clear how the features recited in the Fujitsu abstract anticipate the claimed limitations, Applicants respectfully submit that this is not one of those limited circumstances.

Claim 28 recites that the reception apparatus comprises an operator that determines a correlation between a received signal and a known signal sequence through a vector operation, a first estimator that estimates a first synchronization timing of the received signal based on an operation result of the operator, an operation value ratio table that stores operation value ratios and associated short times, and a second estimator that reads the operation value ratio table, detects an operation value ratio closest to a ratio between the

correlations corresponding to the first synchronization timing, and estimates a timing shifted from the first synchronization timing by a short time corresponding to the detected operation value ratio as a second synchronization timing. Applicants respectfully submit that this combination of features is not disclosed in the Fujitsu abstract. Applicants therefore respectfully submit that the rejection of claim 28 is improper, and request withdrawal of the rejection. Dependent claims 29 and 30 are also submitted to be in condition for allowance at least in view of their dependence on claim 28.

Another feature of the present invention that is not disclosed by the applied prior art is the capability of canceling inter symbol interference using multiple tap coefficients prestored in association with short times and estimating synchronization timings from short times corresponding to the tap coefficient that maximizes the correlation operation result between a signal after interference cancellation and a known signal sequence.

Claim 31 recites that the reception apparatus comprises a canceller that cancels inter symbol interference from a received signal using tap coefficients stored in a tap coefficient table, an operator that determines correlation between signals having inter symbol interference removed and corresponding to the tap coefficients an a known signal sequence, and an estimator that detects a tap coefficient that yields a maximum operation result in the operator and estimates a timing shifted from a predetermined sampling timing by a short time corresponding to the detected tap coefficient as a synchronization timing of the received

signal. Applicants respectfully submit that this combination of features are not disclosed in the Fujitsu abstract. Applicants therefore respectfully submit that the rejection of claim 31 is improper, and request withdrawal of the rejection. Dependent claim 32 is also submitted to be in condition for allowance at least in view of their dependence on claim 31.

Claim 34 recites a reception method and includes limitations similar to those of claim 28. Claim 34 recites determining a correlation between a received signal and a known signal sequence through vector operation, estimating a first synchronization timing of the received signal based on a vector operation result, obtaining from a operation value ratio table operation value ratios indicating ratios between a plurality of correlations determined at sampling timings shifted from ideal sampling timings by short times, detecting an operation value ratio closest to a ratio between the correlations corresponding to the first synchronization timing, and detecting a timing shifted from the first synchronization timing by a short time corresponding to the detected operation value ratio as a second synchronization timing. Applicants respectfully submit that this combination of features is not disclosed in the Fujitsu abstract and request withdrawal of the rejection.

Claim 35 also recites a reception method and includes limitations similar to those of claim 31. Claim 35 recites canceling inter symbol interference from a received signal using tap coefficients in a tap coefficient table, determining a correlation through vector operation between signals having inter symbol interference removed and corresponding to the tap

coefficients and a known signal sequence, detecting a tap coefficient that gives a maximum vector operation result, and estimating a timing shifted from a predetermined sampling timing by a short time corresponding to the detected tap coefficient as a synchronization timing of the received signal. Applicants respectfully submit that this combination of features is not disclosed in the Fujitsu abstract and request withdrawal of the rejection.

Another feature of the present invention, not disclosed in the applied prior art, is a two-step synchronization timing estimation. According to this feature, a first synchronization is estimated at a low accuracy level from correlations of timings. A table is provided that stores operation value ratios and a plurality of associated short times. The operation value ratios are determined from correlations of two neighboring timings, and the short times refer to the shift from ideal synchronization timings. With reference to this table, an operation value that is closest to the ratio between the correlations corresponding to the first synchronization timing is determined as a second synchronization timing of high accuracy.

Newly added claim 36 is directed towards a reception apparatus. Claim 36 recites, *inter alia*, an operator that determines a correlation at each timing of predetermined sampling timings through a vector operation using a sampling result of a receiver and a known signal sequence, and an operation value ratio table that stores operation value ratios and a plurality of associated short times, the operation value ratios indicating ratios between two correlations corresponding to every two neighboring timings in a plurality of sampling

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timings including timings shifted from ideal synchronization timing by short times. Fujitsu does not disclose a two-step synchronization timing estimation including the above-mentioned combination of features, and is therefore submitted to be allowable. Newly added claim 37 is directed towards a reception method and recites related limitations. For at least these reasons, Applicants submit that claims 36 and 37 are allowable.
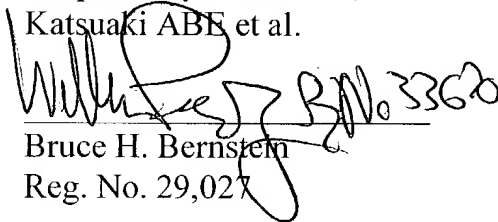
Based on the above, it is respectfully submitted that this application is now in condition for allowance, and a Notice of Allowance is respectfully requested.

SUMMARY AND CONCLUSION

Entry and consideration of the present amendment, reconsideration of the outstanding Office Action, and allowance of the present application and all of the claims therein are respectfully requested and now believed to be appropriate. Applicant has made a sincere effort to place the present invention in condition for allowance and believes that he has now done so.

Should the Examiner have any questions or comments regarding this response, or the present application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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